Warren, E.C.
Thesis 1933

1929 American council education psychological examination...

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BOSTON UNIVERSITY

SCHOOL OF EDUCATION

Thesis

THE 1929 AMERICAN COUNCIL ON EDUCATION PSYCHOLOGICAL EXAMINATION AND ITS RELATIONS TO THE FIRST SEMESTER, FRESHMAN YEAR SCHOLARSHIP OF THE CLASS OF 1933 AT A NORTHEASTERN COLLEGE OF LIBERAL ARTS.

Submitted by

Elmer Chapman Warren

(S.B., Massachusetts Institute of Technology, 1926)

In partial fulfillment of requirements for the degree of

Master of Education

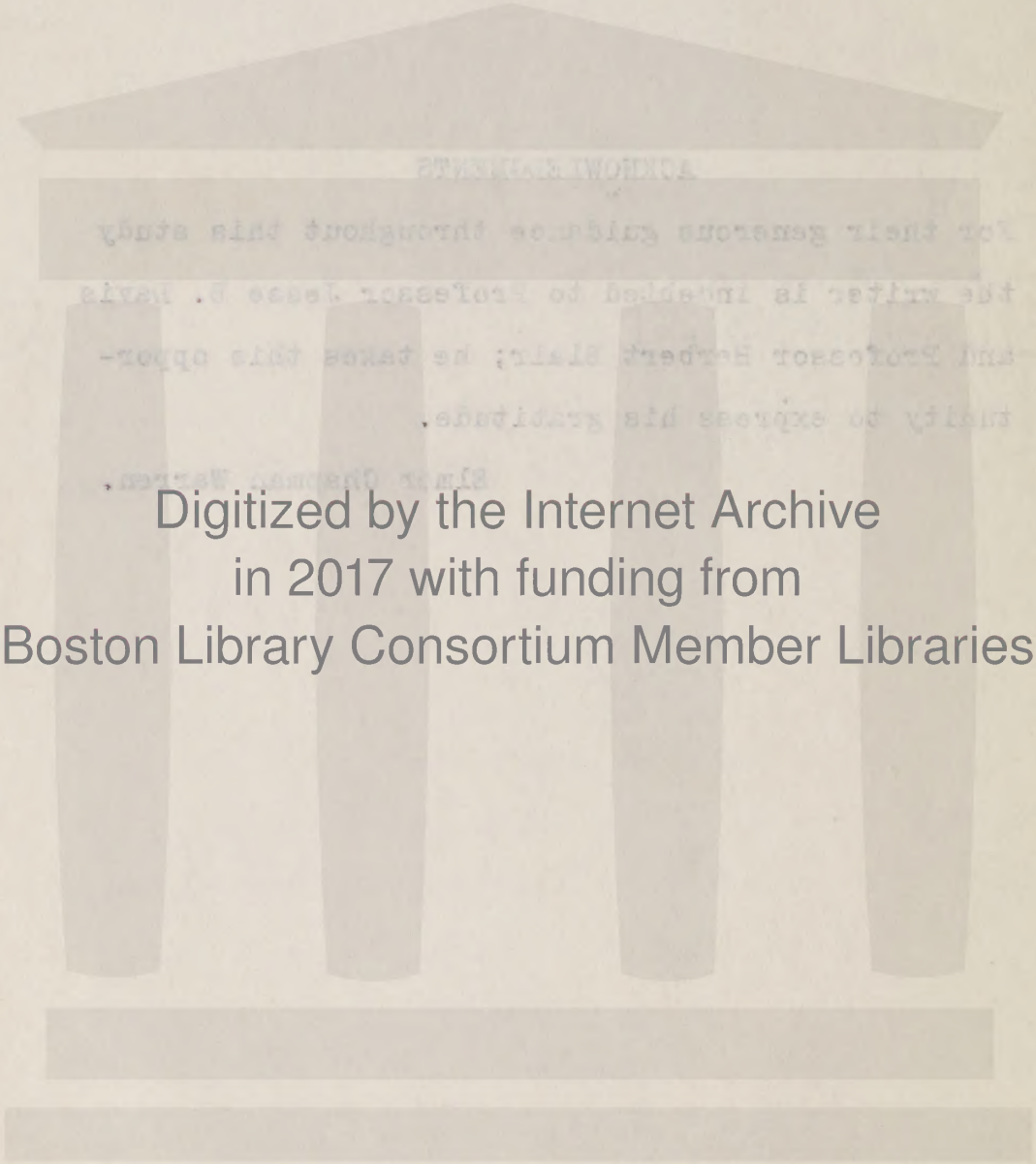
1933

First Reader: Jesse B Davis, Professor of Education
Second Reader: Herbert Blair; Professor of Education.

ACKNOWLEDGMENTS

For their generous guidance throughout this study the writer is indebted to Professor Jesse B. Davis and Professor Herbert Blair; he takes this opportunity to express his gratitude.

Elmer Chapman Warren.



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INTRODUCTION

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STATEMENT OF THE PROBLEM.

The problem in this study was that of determining the relations among a student's scores on specific parts of the American Council on Education Psychological Examination given in September 1929 and his first semester marks in certain college subjects taken in his freshman year.

The students involved in this study were men who entered a northeastern college of liberal arts in the fall of 1929.

The students' scores on the arithmetic and language parts of the psychological examination and their marks in freshman English, foreign language, and mathematics constituted the raw data.

The Class of 1933 was chosen as a sample because it happened to be the senior class at the time this study was being made; this study being a part of what will be a more comprehensive study of one generation of students at the college concerned.

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The results of the study will be of particular local interest. The student population of this college differs from that of many in that it is largely derived from small, and even rural, schools. "College populations also vary in proportionate representation of groups from different schools and localities. In attempting therefore to strike a proper balance between the various possible measures of students' probable scholastic performance at college, every institution must carefully study, in regard to its own particular student body, the relation of every such factor to each other one, and to college work as a whole. The general principles and data developed by any one institution, however, may very possibly be of direct interest and value to others". (2)

REVIEW OF LITERATURE.

In General:

The number of studies in the general field of the prediction of academic success is legion. On the other hand, the available literature dealing with the use of the American Council on Education Psychological Examination is indeed very small; for example, the compilers of the Personnel Bibliographical Index (1) list but ten references to this examination as related to scholarship, and they indicate none of these as of major importance.

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Criteria which are used in the general field of prediction of academic success in college consist of students' previous studies, high school marks, scores on psychological tests, character traits, physical force, ambition, honesty, and social cultivation. (6).

Briefly to summarize some of the conclusions which have been arrived at by reliable investigators and reported in the very extensive literature on general prediction, Stoddard (13) reports correlation between high school averages and first semester college averages from 0.25 to 0.65, centering on 0.40; MacPhail reports 0.29 at Brown University, Johnston reports 0.63 at the University of Minnesota, and Wood 0.33 at Columbia University. What these values mean in terms of prognosis at any given institution cannot be ascertained; each institution must make its own study. Stoddard also reports that a battery of placement examinations (Iowa) used at Case School of Applied Science in 1924 predicted first semester performance to the extent of r=0.75 while the correlations obtained for the same groups using the Army Alpha and the American Council on Education Psychological Examination were 0.49 and 0.62, respectively.

The experience at Yale University has been that predictions are really effective only when they are based on a combination of numerous pre-matriculation data. (2).

Potthoff (10) reports: "No method, or combination of methods, which may be employed at present can give an accurate forecast of the success or failure which all the members of a given group will experience in college work".

Conclusions from other reliable investigators (11)(17) indicate that a group intelligence test is the best single predictive agent; that for prediction in specific courses a subject matter test is the best; and where good records are kept in first class high schools a student's superior standing is an excellent indication of success in college.

English (3) shows that a test which correlates 0.34 with academic grades enables one to predict grades less than 6% better than chance. If r=0.45 one gets a prediction 11% better than chance, and the best correlation expected would give a prediction no better than 36% better than chance. He cites as an example a test correlating 0.45 with grades. With this test one could predict the placement of 34 out of 100 to within ½ step on a five point

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scale. However, he claims one could predict 31 out of 100 without any test.

In Particular:

The following information has been digested from a summary of studies which have been made at various institutions relating to the 1929 examination. (15).

Baylor University:

Correlation between scores on the psychological test and fall quarter averages = 0.361 ± 0.028

Correlation between scores on the psychological test and winter quarter averages = 0.423 ± 0.027

Correlation between scores on the psychological test and spring quarter averages = 0.394 ± 0.029

Correlation between scores on the psychological test and average of English marks in the fall quarter = 0.406 ± 0.032

Correlation between scores on the psychological test and the average of mathematics marks in the fall quarter = 0.331 ± 0.051.

University of Buffalo:

School of Pharmacy:

Correlation between 1929 scores and average marks 0.21 (standards raised that year may account for the low coefficient).

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Correlation between scores on the psychological test and fall quarter averages = 0.351 ± 0.038

Correlation between scores on the psychological test and winter quarter averages = 0.423 ± 0.037

Correlation between scores on the psychological test and spring quarter averages = 0.394 ± 0.039

Correlation between scores on the psychological test and average of English marks in the fall quarter = 0.406 ± 0.038

Correlation between scores on the psychological test and the average of mathematics marks in the fall quarter = 0.331 ± 0.031.

University of Buffalo:

School of Pharmacy:

Correlation between 1929 scores and average marks 0.21 (standards raised that year may account for the low coefficient).

Arts College:

Correlation between test scores and average marks 0.51

Centenary College of Louisiana:

Correlation between test scores and marks, 0.52

Colorado State Teachers' College:

Correlation between tests scores and fall term marks was 0.48; between scores and year marks, 0.50

Duke University:

Correlation between test scores and first semester marks was: 0.548 ± 0.021

University of Michigan:

Correlation between test scores and first semester marks: 0.419

Stephens College:

Correlation between test scores and first semester marks was: 0.51

Professor Woody reports the following r's for first semester marks and test scores (15):

Michigan State College	0.48	Flint Junior College	0.40
Adrian College	0.46	Grand Rapids Jun. Col.	0.41
Albion College	0.45	Highland Pk. Jun. Col.	0.47
Alma College	0.62	Jackson Junior Coll.	0.59
Battle Creek College	0.40	Muskegan Jun. Coll.	0.32
Detroit City College	0.44	Port Huron Jun. Coll.	0.51
Kalamazoo College	0.54	Central State Tea.Col.	0.45
Bay City Junior College	0.52	Detroit Teachers' Col.	0.40
Michigan State Normal	0.49	Western State Tea.Col.	0.49

Arts College:

Correlation between test scores and average marks

0.81

Centenary College of Louisiana:

Correlation between test scores and marks, 0.82

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Battle Creek College	0.40	Muskegon Jun. Coll.	0.82
Detroit City College	0.44	Port Huron Jun. Coll.	0.81
Kalamazoo College	0.84	Central State Tea.Col.	0.45
Bay City Junior College	0.82	Detroit Teachers' Col.	0.40
Michigan State Normal	0.49	Western State Tea.Col.	0.49

F. S. Freeman (4) has developed a table for use in connection with the American Council Psychological Test from which the probability of a students stay in college may be predicted. This resulted from a study of the diagnostic value of the A. C. E. examination with reference, in particular, to ability to remain in school as a criterion of subsequent academic success. The author reports r=0.44 for the relation between first semester scholarship and test scores; he adds that this coefficient diminishes for successive terms -- the diminution being probably due to increased homogeneity brought about by elimination. There seems to be a marked tendency for students falling in the upper deciles to achieve higher averages, to experience fewer academic difficulties, and to survive longer than those in the lower deciles. This tendency is not marked enough to warrant exclusion of a prospective student on the basis of the test alone. A student in the X decile has almost a 50-50 chance of surviving eight semesters. It is quite safe to say, in the aurhor's opinion, that the students falling in the lowest two or three deciles and who persist in doing poor work in the first terms of college maywwell be dropped for their own good and that of the institution. The data which follow are a part of the table prepared by Mr. Freeman:

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Probabilities of remaining a given number of semesters

Decile	Semesters						
	2	3	4	5	6	7	8
I	98.3	95.1	94.3	90.2	89.4	87.8	87.8
V	92.0	82.3	79.6	74.3	73.4	72.5	72.5
X	81.2	67.5	60.6	52.1	51.2	50.4	48.7

E. S. Jones (8) reports a study on the use on intelligence tests, Regents' examinations, and high school marks as bases for prediction. In his study there are some data which are pertinent to the problem at hand. He gives correlations between the A. C. E. test and senior high school grades, and between the A. C. E. test and Regents' scores.

A. C. E. Test	100 Men	55 Women
4th year high school average	0.14	0.22
High school Regents' average	0.55	0.45

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Potthoff (10) finds the following r's:

high school averages (1) A.C.E. scores (2) College averages (3)

$$r_{13} = 0.598 \pm 0.019 \quad r_{23} = 0.501 \pm 0.022$$

$$r_{3.12} = 0.676 \pm 0.016$$

To quote: "...if a minimum score (on the A.C.E. test) had been required for entrance (at U. of Chicago, 1924), a large number of failing students would have been barred only if many successful students had been denied admission at the same time. If the requirement had been placed low enough to bar only a negligible number of students who succeeded, the number of failing students barred would also have been small".

At Purdue University, Stalnaker (12) found the coefficients of correlation between the A. C. E. test and college achievement was 0.57; he reports that it proved to be the only really satisfactory one of a number of tests tried.

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METHODS:

In order that the conclusions and computations in this study might be fair it seemed necessary to make certain adjustments to the raw data.

In the first place, instructors differ widely in marking, and one instructor's mark of "B" may be the equivalent of another's "A", or still another's "C".

To overcome this inevitable discrepancy the following process was employed in order to insure more reasonable results:

1. A list of the first semester, freshman year instructors of the students concerned in this study was prepared. This list is, of course, confidential and cannot be included in this thesis.
2. The marks given by each of these instructors to freshmen at the end of the first semester of the academic year 1929-1930 was obtained.
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4. Each instructor's marks were rated on a five point scale instead of percentages, as they were reported to the Registrar.

   The five point scale was: A=4=weight given to marks falling above 1.5$*; B=3=weight for marks falling between 0.5$ and 1.5$; C=2=weight for marks falling between +0.5$ and -0.5$; D=1= weight for marks falling between -0.5$ and -1.5$; F=0=weight for marks falling below -1.5$. For example, Prof. A's mean mark was 79.85 and the standard deviation, $, was 11.0. Hence, marks given to students by him, and falling between 79.85+5.5 and 79.85-5.5 were given a weight of 2; those between 85.35 and 96.35 a weight of 3; those above 96.35 a weight of 4; those between 74.35 and 63.35 a weight of 1; and those below 63.35 a weight of 0. Each Professor's marks were treated in a similar way, according to the individual means and sigma's.

5. Each students marks in freshman English, foreign language, and mathematics were obtained as they were reported to the Registrar by the professors. These are confidential and do not appear in this thesis except by code.

*The $ is used in this thesis for sigma, standard deviation

4. Each instructor's marks were rated on a five point scale instead of percentages, as they were reported to the Registrar.

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6. Each student's marks were adjusted from the percentage scale to the weight scale depending jointly upon the original mark and by whom it was given. For example, suppose student Smith received a 75% in English from Prof. A, a 65% in foreign language from Prof. R, and an 80% in mathematics from Prof. W. His marks would be changed to conform to whatever weights Professor A's 75%, Professor R's 65%, and Professor W's 80% were worth. As a result of this transformation his marks may have become in terms of weights, 2 in English, 1 in foreign language, and 3 in mathematics. Now, had he studied under three other Professors, A' in English, R' in foreign language, and W' in mathematics he might well have recieved as weights: 3 in English, 2 in foreign language, and 4 in mathematics; all due to the fact that the different instructors' marks would probably be of unequal values. This process of establishing a common base was suggested to the author by Professor Herbert Blair.

The data now consisted of each student's three weights representing his original three percentages, and each

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The data now consisted of each student's three weights representing his original three percentages, and each

student's raw scores on the language part, and the arithmetic part of the psychological test, as well as gross scores.

The arithmetic, language, and gross scores made on the psychological test by the students were now converted to a five point scale in a manner identical with that for converting the course marks, i.e. means and standard deviations were computed and on the basis of these the raw scores were given their corresponding weights.

The raw data were now completely converted from raw percentages as awarded by instructors to students and raw scores on the psychological test to weights in both instances. The data with which computations were made consisted of six weights for each student.

From the revised data the following computations were made:

1. Each student's average weight in three courses.
2. The mean and standard deviation of the course averages; M_1, $\$_1$.
3. The mean and standard deviation of the language weights; M_2, $\$_2$.
4. The mean and standard deviation of the arithmetic weights; M_3, $\$_3$.
5. The coefficient of correlation between the language weights and college averages, r_{12}

6. The coefficient of correlation between the arithmetic weights and college averages, r_{13}.
7. The coefficient of correlation between the language weights and the arithmetic weights, r_{23}.
8. The regression equation for computing and predicting college average from scores made on the language and arithmetic parts of the psychological test.
9. The coefficient of correlation between the gross scores on the psychological test and college averages.
10. The regression equation for predicting the college average from the gross score on the psychological test.
11. Eta between gross scores on the psychological test and college averages.

All the statistical procedures and computations in this thesis were modeled after Garrett. (5).

RESULTS

DETAILED DATA AND THE COMPUTATIONS

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TABLE 1

Column 1 Student

Column 2 English mark in percent

Column 3 English mark in weight

Column 4 Mathematics mark in percent

Column 5 Mathematics mark in weight

Column 6 Foreign language mark in percent

Column 7 Foreign language mark in weight

Column 8 Average of columns 3, 5, 7

Column 9 Score on language part of psychological test

Column 10 Weight of score on language part of psychological test

Column 11 Score on arithmetic part of psychological test

Column 12 Weight of score on arithmetic part of psychological test

Column 13 Gross score on psychological test

Column 14 Weight of gross score on psychological test

TABLE I

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Column 14 Weight of gross score on psychological test

TABLE 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	74	2	75	2	70	2	2.0	31	2	32	2	145	2
2	68	1	0	0	92	3	1.3	25	1	40	3	151	2
3	57	0	81	3	55	0	1.0	21	1	40	3	154	2
4	77	2	71	2	72	2	2.0	16	1	40	3	105	1
5	86	3	83	3	60	1	2.3	33	2	24	2	164	2
6	80	3	81	3	85	3	3.0	50	3	40	3	218	3
7	81	3	88	3	82	2	2.6	60	4	20	1	233	4
8	75	3	83	2	50	0	1.6	30	2	40	3	209	3
9	83	3	88	3	71	2	2.6	25	1	36	3	147	2
10	77	2	85	2	75	2	2.0	27	1	8	0	124	1
11	68	1	96	4	0	0	1.6	37	2	40	3	191	3
12	65	1	84	3	90	3	2.3	26	1	20	1	126	1
13	74	2	78	2	81	3	2.3	32	2	24	2	151	2
14	86	3	93	3	85	3	3.0	56	3	24	2	172	2
15	85	4	65	1	84	3	2.6	50	3	32	2	188	3
16	55	0	62	1	70	1	0.6	19	1	16	1	74	0
17	88	3	90	3	86	3	3.0	47	3	40	3	173	2
18	88	3	98	4	87	3	3.3	45	3	32	2	186	3
19	73	2	88	3	75	2	2.3	43	3	48	4	208	3
20	70	2	78	2	70	1	1.6	27	1	24	2	157	2
21	75	2	83	3	94	3	2.6	38	2	12	1	102	1
22	72	1	72	2	63	1	1.3	26	1	28	2	176	2
23	73	2	62	1	90	3	2.0	37	2	16	1	145	2
24	88	3	78	2	82	3	2.6	38	2	32	2	161	2
25	70	2	86	3	80	2	2.3	24	1	44	3	170	2
26	67	1	73	2	72	2	1.6	17	1	16	1	122	1
27	67	1	0	0	0	0	0.3	13	0	8	0	127	1
28	74	2	82	3	80	3	2.6	25	1	24	2	159	2
29	91	4	89	3	94	4	3.6	52	3	40	3	233	4
30	62	1	78	2	73	2	1.6	50	3	28	2	156	2
31	80	2	86	3	90	3	2.6	47	3	16	1	139	2
32	84	3	93	3	82	2	2.6	31	2	28	2	158	2
33	71	1	77	2	84	3	2.0	39	2	24	2	137	2
34	72	2	67	1	82	2	1.6	34	2	20	1	181	2
35	72	2	68	1	80	2	1.6	31	1	24	2	119	1
36	78	3	88	3	65	1	2.3	37	2	32	2	168	2
37	70	2	0	0	62	1	1.0	19	1	12	1	76	0
38	40	0	69	1	60	0	0.3	42	2	32	2	178	2
39	79	3	80	3	91	3	3.0	37	2	36	3	210	3

TABLE I

1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	74	2	76	2	70	2	2.0	31	2	32	2	165	2
2	68	1	0	0	92	3	1.3	25	1	40	3	151	2
3	87	0	81	3	86	0	1.0	21	1	40	3	154	2
4	77	2	71	2	72	2	2.0	16	1	40	3	108	1
5	86	2	88	3	80	1	1.3	33	2	24	2	164	2
6	80	3	81	3	86	3	3.0	30	3	40	3	218	3
7	81	3	88	3	82	2	2.6	60	4	20	1	233	4
8	78	3	83	2	80	0	1.6	30	2	40	3	209	3
9	83	3	88	3	72	2	2.6	26	1	36	3	147	2
10	77	2	85	2	75	2	2.0	27	1	8	0	124	1
11	68	1	36	4	0	0	1.6	37	2	40	3	131	2
12	65	1	84	3	90	3	2.3	26	1	20	1	126	1
13	74	2	78	2	81	3	2.3	32	2	24	2	151	2
14	86	3	93	3	85	3	3.0	36	3	24	2	172	2
15	85	4	65	1	84	3	2.6	50	3	32	2	188	3
16	56	0	62	1	70	1	0.6	19	1	16	1	74	0
17	88	3	90	3	86	3	3.0	47	3	40	3	172	2
18	86	3	93	4	87	3	3.3	45	3	32	2	186	3
19	73	2	88	3	76	2	2.3	45	3	16	4	208	3
20	70	2	78	2	70	1	1.6	27	1	24	2	157	2
21	78	2	83	3	94	3	2.6	38	2	12	1	102	1
22	72	1	72	2	68	1	1.3	26	1	28	2	176	2
23	73	2	62	1	90	3	2.0	37	2	16	1	146	2
24	89	3	78	2	82	3	2.6	38	2	32	2	161	2
25	70	2	86	3	90	2	2.3	24	1	44	3	170	2
26	67	1	73	2	72	2	1.6	17	1	16	1	122	1
27	67	1	0	0	0	0	0.3	18	0	8	0	127	1
28	74	2	82	3	80	3	2.6	25	1	24	2	159	2
29	91	4	89	3	94	4	3.6	52	3	40	3	233	4
30	62	1	78	2	72	2	1.6	50	3	28	2	156	2
31	80	2	86	3	90	3	2.6	47	3	16	1	139	2
32	84	3	93	3	82	2	2.6	31	2	28	2	158	2
33	71	1	77	2	94	3	2.0	39	2	24	2	187	2
34	72	2	67	1	82	2	1.6	34	2	20	1	131	2
35	72	2	68	1	80	2	1.6	31	1	24	2	119	1
36	78	3	88	3	86	1	2.3	37	2	32	2	168	2
37	70	2	0	0	62	1	1.0	19	1	12	1	76	0
38	40	0	62	1	60	0	0.3	42	2	32	2	178	2
39	79	3	80	3	92	3	3.0	37	2	36	3	210	3

1	2	3	4	5	6	7	8	9	10	11	12	13	14
40	81	2	83	3	78	3	2.6	41	2	36	3	175	2
41	74	2	0	0	80	2	1.3	27	1	16	1	163	2
42	85	3	78	2	93	3	2.6	68	4	16	1	179	2
43	66	1	55	0	31	0	0.3	21	1	20	1	118	1
44	82	3	94	3	90	3	3.0	33	2	24	2	134	1
45	86	3	71	2	85	3	2.6	54	3	20	1	170	2
46	84	4	83	3	93	3	3.3	51	3	40	3	240	4
47	73	2	61	1	70	1	1.3	28	1	24	2	174	2
48	68	1	77	2	75	2	1.6	48	3	16	1	170	2
49	83	3	92	3	84	3	3.0	53	3	52	4	215	3
50	70	2	91	3	80	2	2.3	17	1	12	1	108	1
51	66	1	63	1	80	2	1.3	32	2	16	1	111	1
52	80	2	80	2	70	2	2.0	38	2	44	3	179	2
53	65	1	60	1	84	3	1.6	27	1	24	2	118	1
54	88	3	83	3	88	4	3.3	41	2	48	4	220	3
55	91	4	93	4	85	3	3.6	49	3	64	4	285	4
56	73	1	74	1	80	2	1.3	26	1	12	1	66	0
57	60	1	88	3	85	3	2.3	37	2	48	4	209	3
58	80	2	67	1	70	2	1.6	56	3	36	3	226	3
59	90	3	95	4	80	3	3.3	36	2	32	2	205	3
60	84	4	83	3	91	4	3.6	56	3	28	2	192	3
61	47	0	69	1	40	0	0.3	9	0	48	4	99	1
62	66	1	74	2	75	2	1.6	35	2	32	2	155	2
63	75	3	77	2	65	1	2.0	25	1	52	4	198	3
64	77	3	64	1	70	1	1.6	50	3	28	2	203	3
65	74	2	75	2	75	2	2.0	26	1	16	1	125	1
66	86	3	65	1	0	0	1.3	25	1	24	2	146	2
67	64	0	70	1	0	0	0.3	14	0	4	0	70	0
68	80	2	85	2	94	4	2.6	24	1	20	1	97	1
69	68	2	64	1	38	0	1.0	25	1	28	2	149	2
70	82	3	87	3	77	2	2.6	44	3	16	1	172	2
71	74	2	78	2	75	2	2.0	35	2	32	2	193	3
72	62	1	76	2	76	2	1.6	43	3	32	2	155	2
73	74	2	67	1	70	1	1.3	18	1	32	2	98	1
74	90	3	75	2	84	3	2.6	25	1	12	1	118	1
75	84	3	96	4	91	3	3.3	63	4	44	3	217	3
76	87	3	76	2	97	4	3.0	64	4	32	2	261	4
77	67	1	71	1	63	1	1.0	26	1	20	1	114	1
78	0	0	67	1	70	1	0.6	8	0	36	3	97	1

1	2	3	4	5	6	7	8	9	10	11	12	13	14
40	81	2	83	3	78	3	2.6	41	2	36	3	179	2
41	74	2	0	0	80	2	1.3	27	1	16	1	145	2
42	86	3	73	2	93	3	3.6	68	4	16	1	179	2
43	66	1	65	0	31	0	0.6	31	1	20	1	118	1
44	82	3	94	3	90	3	3.0	83	2	24	2	134	1
45	86	3	71	2	85	3	2.6	54	3	20	1	170	2
46	84	4	83	3	93	3	3.3	51	3	40	3	240	4
47	73	2	61	1	70	1	1.3	36	1	24	2	174	2
48	68	1	77	2	78	2	1.6	46	3	16	1	170	2
49	83	3	92	3	84	3	3.0	83	3	52	4	218	3
50	70	2	71	3	80	2	2.3	17	1	12	1	108	1
51	66	1	63	1	80	3	1.3	33	2	16	1	111	1
52	80	2	80	2	70	2	2.0	38	2	44	3	179	2
53	68	1	60	1	84	3	1.6	27	1	24	2	118	1
54	38	3	83	3	88	4	3.3	41	2	48	4	220	3
55	71	4	93	4	63	3	3.6	49	3	64	4	238	4
56	78	1	74	1	80	2	1.3	26	1	12	1	66	0
57	60	1	86	3	85	3	2.3	37	2	48	4	209	3
58	80	2	67	1	70	2	1.6	56	3	36	3	226	3
59	90	3	95	4	80	3	3.3	36	2	32	2	203	3
60	84	4	83	3	91	4	3.6	56	3	28	2	192	3
61	47	0	69	1	40	0	0.3	9	0	46	4	99	1
62	66	1	74	2	78	2	1.6	36	2	32	2	159	2
63	78	3	77	2	66	1	2.0	26	1	52	4	198	3
64	77	3	64	1	70	1	1.6	60	3	28	2	203	3
65	74	2	78	2	78	2	2.0	26	1	16	1	129	1
66	86	3	65	1	0	0	1.3	26	1	24	2	146	2
67	64	0	70	1	0	0	0.3	14	0	4	0	73	0
68	80	2	85	2	94	4	2.6	24	1	20	1	97	1
69	68	2	64	1	38	0	1.0	26	1	28	2	149	2
70	82	3	87	3	77	2	2.6	44	3	16	1	172	2
71	74	2	76	2	78	2	2.0	36	2	32	2	193	3
72	62	1	76	2	76	2	1.6	46	3	32	2	186	2
73	74	2	67	1	70	1	1.3	18	1	32	2	98	1
74	90	3	78	2	84	3	2.6	26	1	12	1	118	1
75	84	3	96	4	91	3	3.3	63	4	44	3	217	3
76	87	3	76	2	97	4	3.0	64	4	82	2	261	4
77	67	1	71	1	65	1	1.0	26	1	20	1	114	1
78	0	0	67	1	70	1	0.6	8	0	36	3	97	1

The mean and standard deviation of Professor A's marks.

Class	F	D	FD	FD^2
95-99	2	4	8	32
90-94	2	3	6	18
85-89	2	2	4	8
80-84	1	1	1	1
75-79	4	0	0	0
70-74	3	-1	-3	3
65-69	2	-2	-4	8
60-64	0	-3	0	0
55-59	1	-4	-4	16
	17		8	86

Mean = $77.5 + (8/17)5 = 79.85$

$\$ = \sqrt{(86/17)-(8/17)^2}\ x5 = 11.0$

$\$_{av} = 11.0/\sqrt{17} = 2.65$

The mean and standard deviation of Professor A's marks.

Class	f	D	fD	fD^2
95-99	2	4	8	32
90-94	2	3	6	18
85-89	2	2	4	8
80-84	1	1	1	1
75-79	4	0	0	0
70-74	3	-1	-3	3
65-69	2	-2	-4	8
60-64	0	-3	0	0
55-59	1	-4	-4	16
	17		8	86

$$\text{Mean} = 77.5 + (8\backslash17)5 = 79.85$$

$$\$ = \sqrt{(86\backslash17)-(8\backslash17)^2} \times 5 = 11.0$$

$$\$_{AV} = 11.0\backslash\sqrt{17} = 2.65$$

The mean and standard deviation of Professor B's marks.

Class	F	D	FD	FD^2
90-94	2	3	6	18
85-89	6	2	12	24
80-84	6	1	6	6
75-79	7	0	0	0
70-74	7	-1	-7	7
65-69	2	-2	-4	8
60-64	1	-3	-3	9
55-59	1	-4	-4	16
	32		6	88

Mean = $77.5 + (6/32)5 = 78.4$

$\$ = \sqrt{(88/32)-(6/32)^2}\ x5 = 8.2$

$\$_{av} = 8.2/\sqrt{32} = 1.46$

The mean and standard deviation of Professor B's marks.

Class	f	D	fD	fD^2
90-94	2	3	6	18
85-89	6	2	12	24
80-84	6	1	6	6
75-79	7	0	0	0
70-74	7	-1	-7	7
65-69	2	-2	-4	8
60-64	1	-3	-3	9
55-59	1	-4	-4	16
	32		6	88

$$\text{Mean} = 77.5 + (6/32)5 = 78.4$$

$$\sigma = \sqrt{(88/32)-(6/32)^2}\ x5 = 8.2$$

$$\sigma_{SV} = 8.2/\sqrt{32} = 1.46$$

The mean and standard deviation of Professor C's marks.

Class	F	D	FD	FD^2
90-94	4	4	16	64
85-89	4	3	12	36
80-84	9	2	18	36
75-79	4	1	4	4
70-74	6	0	0	0
65-69	0	-1	0	0
60-64	4	-2	-8	16
55-59	1	-3	-3	9
	32		39	165

Mean = $72.5 + (39/32)5 = 78.6$

$\$ = \sqrt{(165/32)-(39/32)^2} \times 5 = 9.6$

$\$_{av} = 9.6/\sqrt{32} = 1.7$

The mean and standard deviation of Professor C's marks.

Class	F	D	FD	FD^2
90-94	4	4	16	64
85-89	4	3	12	36
80-84	9	2	18	36
75-79	4	1	4	4
70-74	6	0	0	0
65-69	0	-1	0	0
60-64	4	-2	-8	16
55-59	1	-3	-3	9
	32		39	165

$$\text{Mean} = 72.5 + (39/32)5 = 78.6$$

$$\hat{\sigma} = \sqrt{(165/32)-(39/32)^2}\ x5 = 9.6$$

$$\hat{\sigma}_{mv} = 9.6/\sqrt{32} = 1.7$$

The mean and standard deviation of Professor D's marks.

Class	F	D	FD	FD^2
90-95	2	4	8	32
85-89	4	3	12	36
80-84	6	2	12	24
75-79	1	1	1	1
70-74	4	0	0	0
65-69	6	-1	-6	6
60-64	3	-2	-6	12
55-59	3	-3	-9	27
	29		12	138

$$\text{Mean} = 72.5 + (12/29)5 = 74.6$$

$$\$ = \sqrt{(138/29)-(12/29)^2}\ x5 = 10.75$$

$$\$_{av} = 10.75/\sqrt{29} = 2.0$$

The mean and standard deviation of Professor D's marks.

Class	F	D	FD	FD^2
90-95	2	4	8	32
85-89	4	3	12	36
80-84	6	2	12	24
75-79	1	1	1	1
70-74	4	0	0	0
65-69	6	-1	-6	6
60-64	3	-2	-6	12
55-59	3	-3	-9	27
	29		12	138

$$\text{Mean} = 72.5 + (12/29)5 = 74.6$$

$$\sigma = \sqrt{(138/29)-(12/29)^2}\ x5 = 10.75$$

$$\sigma_{AV} = 10.75/\sqrt{29} = 2.0$$

The mean and standard deviation of Professor E's marks.

Class	F	D	FD	FD^2
90-94	5	3	15	45
85-89	4	2	8	16
80-84	1	1	1	1
75-79	2	0	0	0
70-74	4	-1	-4	4
65-69	2	-2	-4	8
60-64	1	-3	-3	9
55-59	1	-4	-4	16
	20		9	99

Mean = $77.5 + (9/20)5 = 79.7$

$\$ = \sqrt{(99/20)-(9/20)^2}$ x5= 10.9

$\$_{av} = 10.9/\sqrt{20} = 2.43$

The mean and standard deviation of Professor E's marks.

Class	F	D	FD	FD^2
90-94	3	3	15	45
85-89	4	2	8	16
80-84	1	1	1	1
75-79	2	0	0	0
70-74	4	-1	-4	4
65-69	2	-2	-4	8
60-64	1	-3	-3	9
55-59	1	-4	-4	16
	20		9	99

$$\text{Mean} = 77.5 + (9/20)5 = 79.7$$

$$\sigma = \sqrt{(99/20)-(9/20)^2} \times 5 = 10.9$$

$$\sigma_{\bar{x}} = 10.9/\sqrt{20} = 2.45$$

The mean and standard deviation of Professor F's marks.

Class	F	D	FD	FD^2
95-99	1	4	4	16
90-94	9	3	27	81
85-89	2	2	4	8
80-84	6	1	6	6
75-79	2	0	0	0
70-74	4	-1	-4	4
65-69	3	-2	-6	12
60-64	4	-3	-12	36
55-59	5	-4	-20	80
	36		-1	243

Mean = $77.5 - (1/36)5 = 77.4$

$$\$ = \sqrt{(243/36)-(1/36)^2}\ x5 = 13.0$$

$$\$_{av} = 13.0/\sqrt{36} = 2.16$$

The mean and standard deviation of Professor P's marks.

Class	F	D	FD	FD^2
95-99	1	4	4	16
90-94	3	3	27	81
85-89	2	2	4	8
80-84	6	1	6	6
75-79	2	0	0	0
70-74	4	-1	-4	4
65-69	3	-2	-6	12
60-64	4	-3	-12	36
55-59	5	-4	-20	80
	36		-1	243

$$\text{Mean} = 77.5 - (1/36)5 = 77.4$$

$$\sigma = \sqrt{(243/36) - (1/36)^2} \times 5 = 13.0$$

$$\sigma_{av} = 13.0/\sqrt{36} = 2.16$$

The mean and standard deviation of Professor G's marks.

Class	F	D	FD	FD^2
85-89	1	3	3	9
80-84	5	2	10	20
75-79	7	1	7	7
70-74	12	0	0	0
65-69	13	-1	-13	13
60-64	1	-2	-2	4
55-59	4	-3	-12	36
	43		-7	89

Mean = $72.5 - (7/43)5 = 71.7$

$\$ = \sqrt{(89/43)-(7/43)^2} \times 5 = 6.75$

$\$_{av} = 6.75/\sqrt{43} = 1.03$

The mean and standard deviation of Professor G's marks.

Class	f	D	fD	fD^2
85-89	1	3	3	9
80-84	5	2	10	20
75-79	7	1	7	7
70-74	12	0	0	0
65-69	13	-1	-13	13
60-64	1	-2	-2	4
55-59	4	-3	-12	36
	43		-7	89

$$\text{Mean} = 72.5 - (7/43)5 = 71.7$$

$$\hat{s} = \sqrt{(89/43)-(7/43)^2}\ x5 = 6.15$$

$$\hat{s}_{av} = 6.75/\sqrt{25} = 1.03$$

The mean and standard deviation of Professor H's marks.

Class	F	D	FD	FD^2
90-95	1	4	4	16
85-89	3	3	9	27
80-84	4	2	8	16
75-79	4	1	4	4
70-74	6	0	0	0
65-69	3	-1	-3	3
60-64	4	-2	-8	16
55-59	8	-3	-24	72
	33		-10	154

Mean = $72.5 - (10/33)5 = 71.0$

$\$ = \sqrt{(154/33)-(10/33)^2}\ x5 = 10.7$

$\$_{av} = 10.7/\sqrt{33} = 1.86$

The mean and standard deviation of Professor H's marks.

Class	F	D	FD	FD^2
90-95	1	4	4	16
85-89	3	3	9	27
80-84	4	2	8	16
75-79	4	1	4	4
70-74	6	0	0	0
65-69	3	-1	-3	3
60-64	4	-2	-8	16
55-59	8	-3	-24	72
	33		-10	154

$$\text{Mean} = 72.5 - (10/33)5 = 71.0$$

$$\sigma = \sqrt{(154/33)-(10/33)^2} \times 5 = 10.7$$

$$\sigma_{av} = 10.7/\sqrt{33} = 1.86$$

The mean and standard deviation of Professor I's marks.

Class	F	D	FD	FD^2
95-99	2	4	8	32
90-94	1	3	3	9
85-89	5	2	10	20
80-84	14	1	14	14
75-79	12	0	0	0
70-74	3	-1	-3	3
65-69	10	-2	-20	40
60-64	10	-3	-30	90
55-59	6	-4	-24	96
	63		-42	304

Mean = $77.5 - (42/63)5 = 74.2$

$\$ = \sqrt{(304/63)-(42/63)2}\ x5 = 10.5$

$\$_{av} = 10.5/\sqrt{63} = 1.32$

The mean and standard deviation of Professor I's marks.

Class	F	D	FD	FD^2
95-99	2	4	8	32
90-94	1	3	3	9
85-89	5	2	10	20
80-84	14	1	14	14
75-79	15	0	0	0
70-74	3	-1	-3	3
65-69	10	-2	-20	40
60-64	10	-3	-30	90
55-59	3	-4	-24	96
	63		-42	304

$$\text{Mean} = 77.5 - (42/63)5 = 74.2$$

$$\sigma = \sqrt{(304/63) - (42/63)^2} \times 5 = 10.5$$

$$\sigma_{av} = 10.5/\sqrt{53} = 1.32$$

The mean and standard deviation of the scores on the language part of the psychological examination.

Class	F	D	FD	FD^2
65-69	1	6	6	36
60-64	3	5	15	75
55-59	3	4	12	48
50-54	8	3	24	72
45-49	5	2	10	20
40-44	6	1	6	6
35-39	12	0	0	0
30-34	9	-1	-9	9
25-29	17	-2	-34	68
20-24	4	-3	-12	36
15-19	6	-4	-24	96
10-14	2	-5	-10	50
5-9	2	-6	-12	72
	78		-28	588

Mean = $37.5 - (28/78)5 = 35.7$

$\$ = \sqrt{(588/78) - (28/78)^2} \times 5 = 13.6$

$\$_{av} = 13.6/\sqrt{78} = 1.55$

The mean and standard deviation of the scores on the language part of the psychological examination.

Class	f	D	fD	fD^2
65-69	1	6	6	36
60-64	3	5	15	75
55-59	3	4	12	48
50-54	8	3	24	72
45-49	5	2	10	20
40-44	6	1	6	6
35-39	12	0	0	0
30-34	9	-1	-9	9
25-29	17	-2	-34	68
20-24	4	-3	-12	36
15-19	6	-4	-24	96
10-14	2	-5	-10	50
5-9	2	-6	-12	72
	78		-28	588

$$\text{Mean} = 37.5 - (28\backslash 78)5 = 35.7$$

$$\sigma = \sqrt{(588\backslash 78) - (28\backslash 78)^2} \times 5 = 13.6$$

$$\sigma_{av} = 13.6\backslash\sqrt{78} = 1.55$$

The mean and standard deviation of the scores on the arithmetic part of the psychological examination.

Class	F	D	FD	FD^2
60-64	1	7	7	49
55-59	0	6	0	0
50-54	2	5	10	50
45-49	4	4	16	64
40-44	12	3	36	108
35-39	5	2	10	20
30-34	12	1	12	12
25-29	6	0	0	0
20-24	18	-1	-18	18
15-19	10	-2	-20	40
10-14	5	-3	-15	45
5-9	2	-4	-8	32
0-4	1	-5	-5	25
	78		25	463

Mean = $27.5 + (25/78)5 = 29.1$

$$\$ = \sqrt{(463/78) - (25/78)^2} \times 5 = 12.1$$

$$\$_{av} = 12.1/\sqrt{78} = 1.38$$

The mean and standard deviation of the scores on the arithmetic part of the psychological examination.

Class	f	D	fD	fD^2
60-64	1	7	7	49
55-59	0	6	0	0
50-54	2	5	10	50
45-49	4	4	16	64
40-44	12	3	36	108
35-39	8	2	16	32
30-34	12	1	12	12
25-29	6	0	0	0
20-24	18	-1	-18	18
15-19	10	-2	-20	40
10-14	6	-3	-18	54
5-9	2	-4	-8	32
0-4	1	-5	-5	25
	72		29	485

$$\text{Mean} = 27.5 + (29/72)5 = 29.1$$

$$\sigma = \sqrt{(485/72)-(29/72)^2}\ x5 = 12.1$$

$$\sigma_{AV} = 12.1/\sqrt{72} = 1.38$$

Mean and standard deviation of the gross scores on the psychological examination.

Class	F	D	FD	FD^2
275-299	1	5	5	25
250-274	1	4	4	16
225-249	4	3	12	36
200-224	10	2	20	40
175-199	12	1	12	12
150-174	20	0	0	0
125-149	11	-1	-11	11
100-124	11	-2	-22	44
75-99	5	-3	-15	45
50-74	3	-4	-12	48
	78		-7	277

Mean = $162.5 - (7.78)25 = 160.25$

$\$ = \sqrt{(277/78) - (7/78)^2} \times 25 = 47.0$

$\$_{av} = 47.0/\sqrt{78} = 5.36$

Mean and standard deviation of the gross scores on the psychological examination.

Class	f	d	fd	fd^2
275-299	1	5	5	25
250-274	1	4	4	16
225-249	4	3	12	36
200-224	10	2	20	40
175-199	12	1	12	12
150-174	20	0	0	0
125-149	11	-1	-11	11
100-124	11	-2	-22	44
75-99	5	-3	-15	45
50-74	3	-4	-12	48
	78		-7	277

$$\text{Mean} = 162.5 - (7.78)25 = 160.25$$

$$\sigma = \sqrt{(277/78) - (7/78)^2}\ 25 = 47.0$$

$$\sigma_{\bar{M}} = 47.0/\sqrt{78} = 5.36$$

Mean and standard deviation of the average weights of the first semester marks.

Class	F	D	FD	FD^2
3.00-3.99	15	1	15	15
2.00-2.99	31	0	0	0
1.00-1.99	25	-1	-25	25
0.00-0.99	7	-2	-14	28
	78		-24	68

$$\text{Mean} = 2.5 - (24/78) = 2.2 = M_1$$

$$\$ = \sqrt{(68/78) - (24/78)^2} = 0.88 = \$_1$$

$$\$_{av} = 0.88/\sqrt{78} = 0.10$$

Mean and standard deviation of the average weights of the first semester marks.

Class	F	D	FD	FD^2
3.00-3.99	15	1	15	15
2.00-2.99	31	0	0	0
1.00-1.99	25	-1	-25	25
0.00-0.99	7	-2	-14	28
	78		-24	68

$$\text{Mean} = 2.5 - (24/78) = 2.2 = M_1$$

$$\sigma_1 = \sqrt{(68/78)-(24/78)^2} = 0.88 = \sigma_1$$

$$\sigma_{AV} = 0.88/\sqrt{78} = 0.10$$

Mean and standard deviation of the weights of the scores on the language part of the psychological examination.

Class	F	D	FD	FD^2
4.00-4.99	4	2	8	16
3.00-3.99	19	1	19	19
2.00-2.99	24	0	0	0
1.00-1.99	27	-1	-27	27
0.00-0.99	4	-2	-8	16
	78		-8	78

$$\text{Mean} = 2.5 - (8/78) = 2.4 = M_2$$

$$\$ = \sqrt{(78/78) - (8/78)^2} = 1.0- = \$_2$$

$$\$_{av} = 1.0/\sqrt{78} = 0.114$$

Mean and standard deviation of the weights of the scores on the language part of the psychological examination.

Class	f	D	fD	fD^2
4.00-4.99	4	2	8	16
3.00-3.99	19	1	19	19
2.00-2.99	24	0	0	0
1.00-1.99	27	-1	-27	27
0.00-0.99	4	-2	-8	16
	78		-8	78

$$M_s = \text{Mean} = 2.5 - (8/78) = 2.4$$

$$\sigma_s^2 = 1.0 - (8/78)^2 = \sqrt{(78/78)}$$

$$\sigma_{av} = 1.0/\sqrt{6} = 0.114$$

Mean and standard deviation of the weights of the scores on the arithmetic part of the psychological examination.

Class	F	D	FD	FD^2
4.00-4.99	7	2	14	28
3.00-3.99	17	1	17	17
2.00-2.99	29	0	0	0
1.00-1.99	22	-1	-22	22
0.00-0.99	3	-2	-6	12
	78		3	79

Mean = 2.5 + (3/78) = 2.54 = M_3

$\$ = \sqrt{(79/78)-(3/78)^2} = 1.0- = \$_3$

$\$_{av} = 1.0/\sqrt{78} = 0.114$

Mean and standard deviation of the weights of the scores on the arithmetic part of the psychological examination.

Class	f	d	fd	fd^2
4.00-4.99	7	2	14	28
3.00-3.99	17	1	17	17
2.00-2.99	29	0	0	0
1.00-1.99	22	-1	-22	22
0.00-0.99	3	-2	-6	12
	78		3	79

$$\text{Mean} = 2.5 + (3/78) = 2.54 = M_3$$

$$\sigma = \sqrt{(79/78)-(3/78)^2} = 1.0- = \sigma_3$$

$$S_{av} = 1.0/\sqrt{78} = 0.114$$

Determination of the correlation between the scores on the language part of the psychological examination (X), and the first semester averages (weights) (Y).

	0	1	2	3	4	F_y	D_y	FD	FD^2	+xy	-xy
4											
3			-1 4 -4	0 9	1 2 2	15	1	15	15	2	4
2		0 11	0 13	0 5	0 2	31	0	0	0		
1		2 14 28	1 6 6	0 5		25	-1	-25	25	34	
0	6 4 24	4 2 8	2 1 2			7	-2	-14	28	34	
F_x	4	27	24	19	4	78		-24	68	70 +66	4
D_x	-3	-2	-1	0	1						
FD	-12	-54	-24	0	4	=-86					
FD^2	36	108	24	0	4	=172					

$$r = \frac{\frac{66}{78} - \left(-\frac{24}{78}\right)\left(-\frac{86}{78}\right)}{1 \times 0.88} = 0.58, \; r_{12}$$

$$P.E._r = \frac{.6745(1-0.58^2)}{\sqrt{78}} = 0.051$$

Determination of the correlation between the scores on the language part of the psychological examination (X), and the first semester averages (weights) (Y).

	0	1	2	3	4	D_Y	fD	fD_S	$+xy$	$-xy$
4										
3			-1 4	0 3	1 2	1	15	15	5	4
2			0 13	0 5	0 2	0	0	0		
1		0 11	2 14	0 3	1 6	-1	-25	25	34	
0	6 4 24	2 8	1 2 5			-2	-14	28	34	
D_X	4	27	24	19	4	-24	68	70	4	
	-3	-2	-1	0	1					
fD	-12	-64	-24	0	4					
fD_S	36	108	24	0	4					

$$r = \frac{\frac{68}{56} - \left(-\frac{24}{78}\right)\left(\frac{38}{78}\right)}{1 \times 0.88} = 0.58, \; r_{15}$$

$$P.E._r = \frac{.6745(1-0.58^2)}{\sqrt{78}} = 0.051$$

Determination of the correlation between the scores on the arithmetic part of the psychological examination (X), and the first semester averages (weights) (Y).

	0	1	2	3	4	F_y	D_y	FD	FD^2	+xy	-xy
4											
3			-1 6 -6	0 6	1 3 3	15	1	15	15	3	6
2	0 1	0 12	0 10	0 5	0 3	31	0	0	0		
1		2 8 16	1 12 12	0 5		25	-1	-25	25	28	
0	6 2 12	4 2 8	2 1 2	0 1	-2 1 -2	7	-2	-14	28	22	2
F_x	3	22	29	17	7	78		-24	68	53	8
											+45
D_x	-3	-2	-1	0	1						
FD	-9	-44	-29	0	7	-75					
FD^2	27	88	29	0	7	151					

$$r = \frac{\frac{45}{78} - \left(-\frac{24}{78}\right)\left(-\frac{75}{78}\right)}{1 \times 0.88} = 0.32, \; r_{13}$$

$$P.E._r = \frac{.6745(1-0.32^2)}{\sqrt{78}} = 0.069$$

Determination of the correlation between the scores on the arithmetic part of the psychological examination (X), and the first semester averages (weights) (Y).

	0	1	2	3	4	D_Y	F_Y	PD	PD_S	$+x_Y$	$-x_Y$
4											
3					1	1	15	15	6	3	6
2	1	12	10	3	3	0	31	0	0		
1		8	12	3	0	-1	25	-25	25	28	
0	12	3	3	1	0	-2	7	-14	28	22	2
F_X	3	22	29	17	7		78	-24	68	53	8
D_X	-3	-2	-1	0	1						
PD	-3	-44	-29	0	7	-75					
PD_S	27	88	29	0	7	151					

$$r = \frac{\frac{45}{78} - \left(\frac{24}{78}\right)\left(\frac{75}{78}\right)}{1 \times 0.88} = 0.32, \quad r^2 = 13$$

$$P.E._r = \frac{.6745(1-0.32^2)}{\sqrt{78}} = 0.069$$

Determination of the correlation between the scores on the arithmetic part of the psychological examination (X), and the scores on the language part of the psychological examination (Y).

	0	1	2	3	4	F_y	D_y	FD	FD^2	+xy	-xy
4		-2 2 -4	-1 1 -1	0 1		4	1	4	4		5
3		0 4	0 7	0 5	0 3	19	0				
2		2 4 8	1 13 13	0 5	-1 2 -2	24	-1	-24	24	21	2
1	6 1 6	4 12 48	2 8 16	0 5	-2 1 -2	27	-2	-54	108	70	2
0	9 2 18			0 1	-3 1 -3	4	-3	-12	36	18	3
F_x	3	22	29	17	7	78		-86	172	109	12
										+97	
D_x	-3	-2	-1	0	1						
FD	-9	-44	-29		7	-75					
FD^2	27	88	29		7	151					

$$r = \frac{\frac{97}{78} - \left(-\frac{86}{78}\right)\left(-\frac{75}{78}\right)}{1x1} = 0.18, \; r_{23}$$

$$P.E._r = \frac{.6745(1-0.18^2)}{\sqrt{78}} = 0.074$$

Determination of the correlation between the scores on the arithmetic part of the psychological examination (X), and the scores on the language part of the psychological examination (Y).

	0	1	2	3	4	f_y	D_y	PD	PD_S	$-xy$	$+xy$
4		-2 -4	-1 1	0 1		4	1	4	4		6
3			0 7	0 5	0 3	19	0				
2		2 4 8	1 13 13	0 5	-1 -2 5	24	-1	-24	24	21	2
1	6 1 6	4 12 48	2 8 16	0 5	-2 1 -5	27	-2	-54	108	70	2
0	18 3 9			1 0	-3 1 -3	4	-3	-12	36	18	3
f_x	3	22	29	17	7	78		-86	172	$\frac{109}{+37}$	12
D_x	-3	-2	-1	0	1						
PD	-9	-44	-29		7	-75					
PD_S	27	88	29		7	151					

$$r = \frac{\frac{27}{75} - \left(\frac{86}{78}\right)\left(-\frac{78}{78}\right)}{1x1} = 0.18, \; r^2 = .03$$

$$P.E._r = \frac{.6745(1-0.18^2)}{\sqrt{78}} = 0.074$$

The Regression Equation:

$$x_1 = b_{12.3}x_2 + b_{13.2}x_3$$

College average (1) — Language (2) — Arithmetic (3)

$r_{12}=0.58$

$r_{13}=0.32$

$r_{23}=0.18$

$M_1=2.2$ $M_2=2.4$ $M_3=2.54$

$\$_1=0.88$ $\$_2=1.0$ $\$_3=1.0$

$$b_{12.3}=r_{12.3}\frac{\$_{1.23}}{\$_{2.13}} \qquad b_{13.2}=r_{13.2}\frac{\$_{1.23}}{\$_{3.12}}$$

$$r_{12.3}=\frac{r_{12}-r_{13}r_{23}}{\sqrt{1-r_{13}^2}\sqrt{1-r_{23}^2}}=\frac{.58-.32x.18}{.9474x.9837}=0.56$$

$$r_{13.2}=\frac{r_{13}-r_{12}r_{23}}{\sqrt{1-r_{12}^2}\sqrt{1-r_{23}^2}}=\frac{.32-.58x.18}{.8146x.9837}=0.275$$

$$\$_{1.23}=\$_1\sqrt{1-r_{12}^2}\sqrt{1-r_{13.2}^2}=.88x.8146x.9615=0.69$$

$$\$_{2.13}=\$_2\sqrt{1-r_{23}^2}\sqrt{1-r_{12.3}^2}=1x.9837x.8285=0.81$$

$$\$_{3.12}=\$_3\sqrt{1-r_{23}^2}\sqrt{1-r_{13.2}^2}=1x.9837x.9615=0.95$$

$$b_{12.3}=(r_{12.3})(\$_{1.23})/(\$_{2.13})=0.477$$

$$b_{13.2}=(r_{13.2})(\$_{1.23})/(\$_{3.12})=0.20$$

$$x_1 = 0.477x_2 + 0.20x_3$$

Score form: $X_1 = .48X_2 + .20X_3 + 0.55$

$\$_{(est.X_1)}= 0.69$, P.E. $= 0.465$, $R_{1(23)}= 0.60$

The Regression Equation:

$$X_1 = b_{12.3}X_2 + b_{13.2}X_3$$

College average (1)	Language (2)	Arithmetic (3)
	$r_{12}=0.58$	$r_{23}=0.18$
	$r_{13}=0.32$	
$M_1=52.2$	$M_2=52.4$	$M_3=52.64$
$\sigma_1=0.88$	$\sigma_2=1.0$	$\sigma_3=1.0$

$$b_{12.3}=r_{12.3}\frac{\sigma_1}{\sigma_2} \qquad b_{13.2}=r_{13.2}\frac{\sigma_1}{\sigma_3}$$

$$r_{12.3}=\frac{r_{12}-r_{13}r_{23}}{\sqrt{1-r_{13}^2}\sqrt{1-r_{23}^2}}=\frac{.58-.32x.18}{.9474x.9837}=0.56$$

$$r_{13.2}=\frac{r_{13}-r_{12}r_{23}}{\sqrt{1-r_{12}^2}\sqrt{1-r_{23}^2}}=\frac{.32-.58x.18}{.8146x.9837}=0.276$$

$$\sigma_{1.23}=\sigma_1\sqrt{1-r_{12}^2}\sqrt{1-r_{13.2}^2}=.88x.8146x.9615=0.69$$

$$\sigma_{2.13}=\sigma_2\sqrt{1-r_{23}^2}\sqrt{1-r_{12.3}^2}=1x.9837x.8286=0.81$$

$$\sigma_{3.12}=\sigma_3\sqrt{1-r_{23}^2}\sqrt{1-r_{13.2}^2}=1x.9837x.9615=0.95$$

$$b_{12.3}=(r_{12.3})(\sigma_{1.23})/(\sigma_{2.13})=0.477$$

$$b_{13.2}=(r_{13.2})(\sigma_{1.23})/(\sigma_{3.12})=0.20$$

$$X_1 = 0.477x_2 + 0.20x_3$$

Score form: $X_1 = .48X_2 + .20X_3 - 0.36$

$\sigma_{est.X_1} = 0.69$, P.E. $= 0.465$, $R_{1(23)} = 0.60$

Determination of the correlation between the gross scores (X) on the psychological examination and the college averages (weights) (Y).

	0	1	2	3	4	F_y	D_y	FD	FD^2	+xy	-xy
4											
3		-1 1 -1	0 2	1 8 8	2 4 8	15	1	15	15	16	1
2		0 8	0 17	0 5	0 1	31	0	0	0		
1	2 2 4	1 6 6	0 13	-1 4 -4		25	-1	-25	25	10	4
0	4 2 8	2 4 8	0 1			7	-2	-14	28	16	
F_x	4	19	33	17	5	78		-24	68	42	5
										+37	
D_x	-2	-1	0	1	2						
FD	-8	-19		17	10						
FD^2	16	19		17	20	72					

$$r = \frac{\frac{37}{78} - \left(-\frac{24}{78}\right)(0)}{(0.96)(0.88)} = 0.562, \; r_{ga}$$

$$P.E._r = \frac{.6745(1-0.562^2)}{\sqrt{78}} = 0.052$$

Determination of the correlation between the gross scores (X) on the psychological examination and the college averages (weights) (Y).

	0	7	6	5	4	3	2	1	0
4									
3		-1 7	0	1 2	4 3	8 8	2	-1	16
2			8 0	0	1 0	0	14 0	0	0
1	2 3	6	7	0	-4 4	-1	13	-4	25
0	3 2 4	2	4	1 0					4
D^x	-2	-1	0	1	2				
fD	-8	-19		17	10				
fD_S	16	19		17	20	12			

D^y	f^y	4	3	2	1	0	fD	fD_S	$+xy$	$-xy$
1	15	4	8 8 3	5	-1	-1	15	15	16	1
0	21	0	0	14	0	8	0	0		
-1	25		0	13	0	6	-25	25	10	4
-2	7			1	4 3	4 2	-14	28	16	
-3	4			2	9	19	-24	68	$\frac{42}{+3Y}$	$\frac{5}{-3Y}$

$$r = \frac{\frac{37}{78} - \left(-\frac{24}{78}\right)(0)}{(0.96)(0.88)} = 0.865, \quad x^{E_x}$$

$$P.E._r = \frac{.6745(1-0.865^2_S)}{\sqrt{78}} = 0.052$$

The regression equation for predicting college average from gross scores on the psychological tests then becomes:

$$y = .562 \frac{.88}{.96} x$$

$$= 0.51x$$

In score form:

$$Y = 0.51X + 0.93$$

$$\$_{(est.Y)} = 0.88x0.83 = 0.73\pm$$

$$P.E. = 0.493$$

The regression equation for predicting college average from grade scores on the psychological tests then becomes:

$$y = .862 \frac{.98}{.76} x$$

$$= 0.81x$$

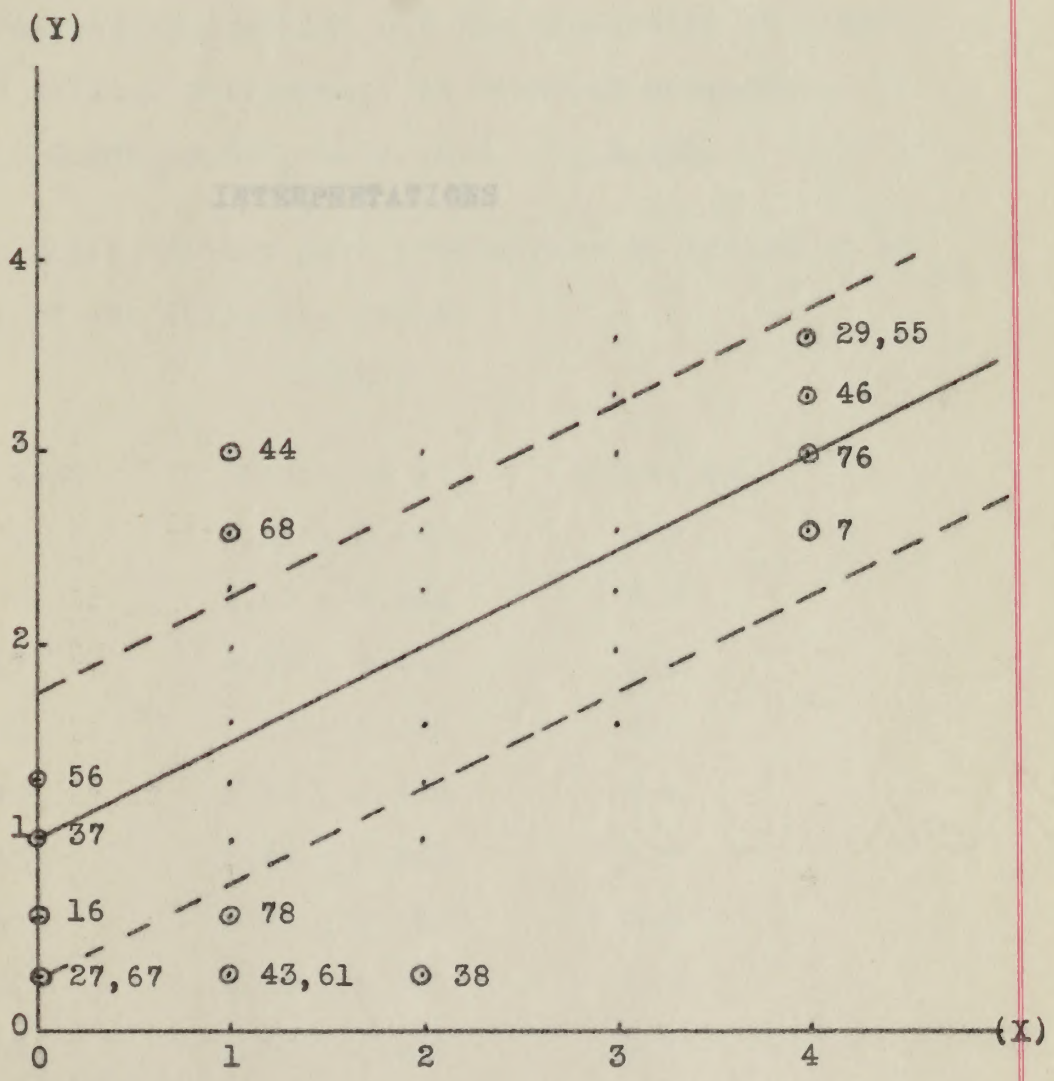
In score form:

$$Y = 0.81X + 0.93$$

$$\beta_{(est.Y)} = 0.88x0.83 = 0.73$$

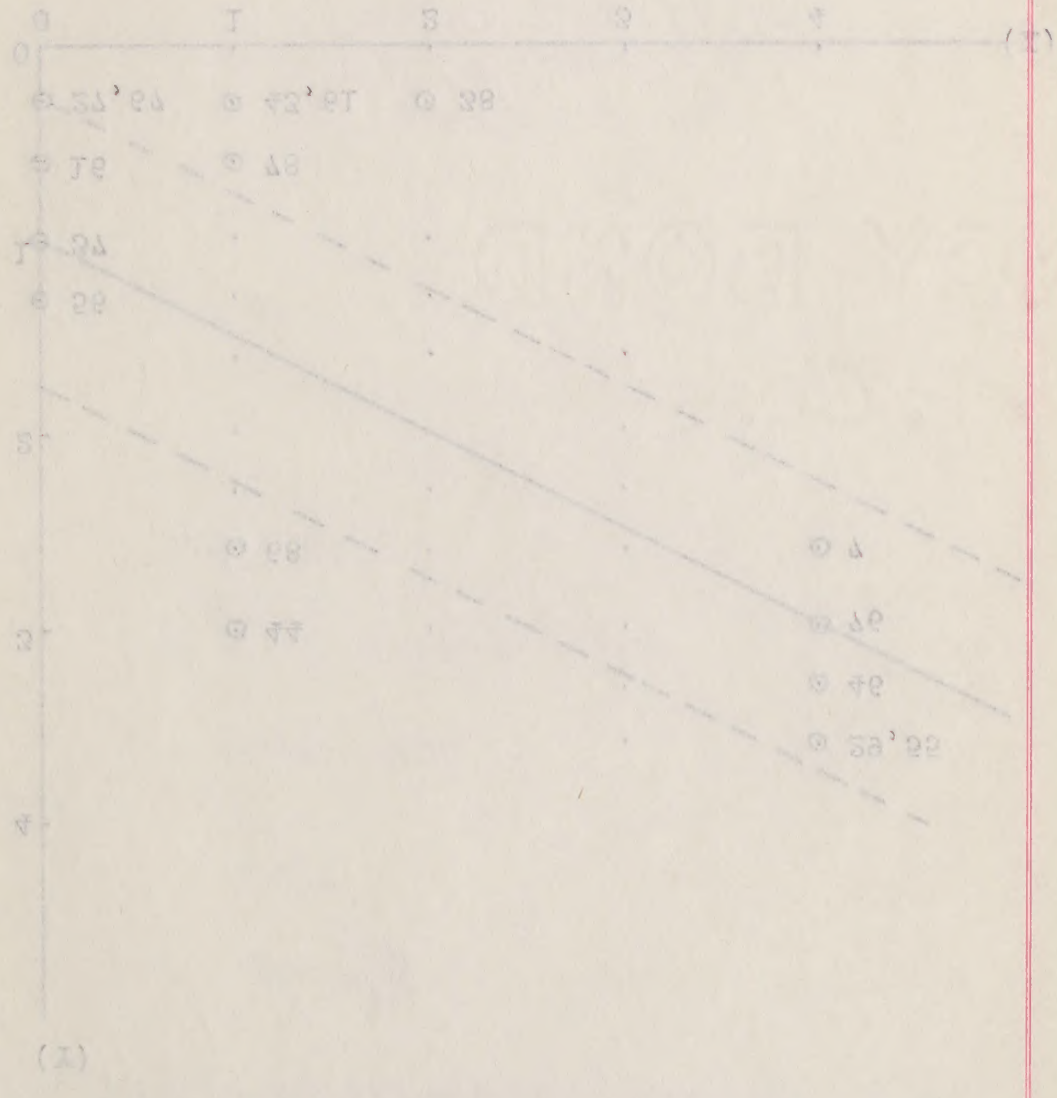
$$P.E. = 0.493$$

ILLUSTRATION 1



Graph showing the relation between gross weights on the psychological test (X) and average weights in college courses (Y): Y=0.51X+0.93

Numbered dots indicate specific students' positions.



INTERPRETATIONS

A sample of the students was taken and their language weights, X_1, and arithmetic weights, X_2, were substituted in the regression equation for the prediction of first-semester college performance in terms of weights:

$$X_1 = 0.48X_2+0.20X_3+0.55, \text{ P.E.} = \pm 0.465.$$

The substitutions gave predictions as indicated in column 2 of the following table:

TABLE 2

1 Student	2 Predicted wt.	3 Actual wt.
1	2.01 ± 0.465	2.0
9	1.63 ± 0.465	2.6
17	2.59 ± 0.465	3.0
25	1.63 ± 0.465	2.3
33	1.91 ± 0.465	2.0
41	1.23 ± 0.465	1.3
49	2.79 ± 0.465	3.0
57	2.36 ± 0.465	2.3
65	1.23 ± 0.465	2.0
73	1.43 ± 0.465	1.3

The prediction of weights is not too far in error to be classed as useless, if it is used as <u>one</u> criterion among several.

A sample of the students was taken and their language weights, X_1, and arithmetic weights, X_2, were substituted in the regression equation for the prediction of first-semester college performance in terms of weights:

$$X_1 = 0.48X_2 + 0.20X_3 + 0.55, \quad P.E. = \pm 0.465.$$

The substitutions gave predictions as indicated in column 2 of the following table:

TABLE 2

1 Student	2 Predicted wt.	3 Actual wt.
1	2.01 ± 0.465	2.0
9	1.83 ± 0.465	2.6
17	2.89 ± 0.465	3.0
25	1.63 ± 0.465	2.3
33	1.91 ± 0.465	2.0
41	1.23 ± 0.465	1.3
49	2.79 ± 0.465	3.0
57	2.86 ± 0.465	2.3
65	1.29 ± 0.465	2.0
73	1.43 ± 0.465	1.3

The prediction of weights is not too far in error to be classed as useless, if it is used as one criterion among several.

The P.E. of the predicted college average weights is $\pm$ 0.465 of a point. If we wish to predict to one point then the allowable deviation will be 1/0.465, or $\pm$ 2.15 P.E. Between 0 P.E. and 2.15 P.E. we find there are 4265 cases out of 10,000, assuming a normal distribution. This means, in the case at hand, that 8530 cases in 10,000 will be predicted to an accuracy of one point on the point scale used. This predictive ability is of real positive value to an admission officer as one criterion of a student's potentialities.

The weights corresponding to the gross scores on the psychological test (scores made by the students in the sample) were substituted in the regression equation for predicting first semester weights from gross score weights: $Y = 0.51X + 0.93$, $\pm$ 0.49, P.E. These gave the predicted weights as indicated in column 2 of the table on the next page.

The P.E. of the predicted college average weights is ± 0.465 of a point. If we wish to predict to one point then the allowable deviation will be 1/0.465, or ± 2.15 P.E. Between 0 P.E. and 2.15 P.E. we find there are 4265 cases out of 10,000, assuming a normal distribution. This means, in the case at hand, that 8530 cases in 10,000 will be predicted to an accuracy of one point on the point scale used. This predictive ability is of real positive value to an admission officer as one criterion of a student's potentialities.

The weights corresponding to the gross scores on the psychological test (scores made by the students in the sample) were substituted in the regression equation for predicting first semester weights from gross score weights: Y = 0.81X + 0.33, ± 0.49, P.E. These gave the predicted weights as indicated in column 2 of the table on the next page.

TABLE 3

1 Student	2 Predicted wt.	3 Actual wt.
1	1.95 ± 0.49	2.0
9	1.95 ± 0.49	2.6
17	1.95 ± 0.49	3.0
25	1.95 ± 0.49	2.3
33	1.95 ± 0.49	2.0
41	1.95 ± 0.49	1.3
49	2.46 ± 0.49	3.0
57	2.46 ± 0.49	2.3
65	1.44 ± 0.49	2.0
73	1.44 ± 0.49	1.3

It is seen here that there is not the diversity possible by using this equation for prediction, for only one weight affects the predicted weight, where in the previous case the prediction depended upon two weights. These predictions do not agree as well with the actual performances, either.

The history of the students represented by the encircled dots in figure 1 was studied. Of the students whose weights were 0 on the psychological examination, numbers 27, 37, and 67 were failed in so many courses that they

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The history of the students represented by the encircled dots in Figure 1 was studied. Of the students whose weights were 0 on the psychological examination, numbers 27, 37, and 67 were failed in so many courses that they

were dropped from the college; numbers 16 and 56 have survived to the senior year but their records are poor. In the cases of those weighting 1: 43 and 61 failed to continue in college for any time; 78 has been a hard working, slow, and persistent student who is now a senior; numbers 44 and 68 have proved to be very good students, evidently samples of that type of students who does not show up too well on psychological examinations. Number 38, who rated 2 on the psychological test, but showed his weakness in his courses was dropped for poor scholarship. Numbers 29, 46, and 55 have proved to be excellent students of high achievements and abilities, one of them a Rhodes Scholar candidate. Numbers 7 and 76 have been very good students, but not exceptional.

Such experiences as the above indicate that those rating 0 for their psychological test weight are very poor risks in any event, and probably will not be able to complete successfully their college career; those rating 4 are honor material.

This study indicates noticeable correlation between scores on the American Council on Education Psychological Examination and first semester performance among freshmen at X College. The 1929 examination and the Class of 1933

were used as the bases of this study.

It may be concluded that the examination can be employed as a safe guide to indicate early in the academic year what students ought to be very carefully watched by the administrators and teaching staff from the standpoint of possible failure and of unusual achievement. Probably conclusions ought not be based on test scores alone, for there seems to be a possibility of students scoring low or high on the test and reversing this in their college work.

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SUMMARY

SUMMARY SHEET

Psychological Test

	Mean	$	$_{av}
Language Scores	35.7	13.6	1.55
Arithmetic Scores	29.1	12.1	1.38
Gross Scores	160.25	47.0	5.36
Language Weights	2.4	1.0	0.114
Arithmetic Weights	2.54	1.0	0.114

College Marks

Professor			
A	79.8	11.0	2.65
B	78.4	8.2	1.46
C	78.6	9.6	1.70
D	74.6	10.8	2.00
E	79.7	10.9	2.43
F	77.4	13.0	2.16
G	71.7	6.7	1.03
H	71.0	10.7	1.86
I	74.2	10.5	1.32
First Semester Weights	2.2	0.88	0.10

Correlations

Language part of test and first semester averages 0.58 ± 0.051

Arith'tic part of test and first semester averages 0.32 ± 0.069

Arithmetic and language parts of test 0.18 ± 0.074

Regression equation for predicting college average from the scores on the language and arithmetic parts of the test, X_2 and X_3, respectively: $X_1 = 0.48X_2 + 0.20X_3 + 0.55$

$\$_{est} = 0.69$

$P.E._{est} = 0.465$

Gross Scores and college averages 0.562 ± 0.052

Regression equation for predicting college average from gross scores: $Y = 0.51X + 0.93$, $\$_{est} = 0.73$, $P.E._{est} = 0.493$

SUMMARY SHEET

Psychological Test

	Mean	σ	σ_{av}
Language Scores	35.7	13.6	1.35
Arithmetic Scores	29.1	12.1	1.28
Gross Scores	160.25	47.0	5.36
Language Weights	2.4	1.0	0.114
Arithmetic Weights	2.84	1.0	0.114

College Marks

Professor			
A	79.3	11.0	2.85
B	73.4	8.2	1.46
C	78.6	9.6	1.70
D	74.6	10.3	2.00
E	75.7	10.9	2.43
F	77.4	13.0	2.16
G	71.7	6.7	1.03
H	71.0	10.7	1.86
I	74.2	10.6	1.32

First Semester Weights 2.2 0.88 0.10

Correlations

Language part of test and first semester average 0.38 ± 0.09

Arithmetic part of test and first semester average 0.22 ± 0.09

Arithmetic and language parts of test 0.18 ± 0.07

Regression equation for predicting college average from the scores on the language and arithmetic parts of the test, X_2 and X_3, respectively: $X_1 = 0.48X_2 + 0.20X_3 + 0.35$

$\phi_{est} = 0.69$

$P.E._{est} = 0.465$

Gross Scores and college averages 0.56 ± 0.08

Regression equation for predicting college average from Gross scores: $Y = 0.01X + 0.93$, $\phi_{est} = 0.73$, $P.E._{est} = 0.493$

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APPENDIX

SUMMARY OF DATA RELATIVE TO THE A. C. E. PSYCHOLOGICAL EXAMINATIONS GIVEN AT X COLLEGE, 1929-1932.

	1929	1930	1931	1932
Mean gross score	157.5	157.8	158.2	173.5
$, gross scores	45.5	54.8	50.3	53.2
Number taking exam.	101	123	114	111
$\$_{av}$	4.6	4.9	4.7	5.1

Standard deviation of the difference between the means

1929-1930	0.0447
1929-1931	0.107
1929-1932	2.36
1930-1931	0.0585
1930-1932	2.22
1931-1932	2.22

While the $\$_{diff'}$'s between the present freshman class and the other three classes are less than 3.00, they indicate a problem for investigation as to the reason for the large values

SUMMARY OF DATA RELATIVE TO THE A. C. E. PSYCHOLOGICAL EXAMINATIONS GIVEN AT X COLLEGE, 1929-1932.

	1929	1930	1931	1932
Mean gross score	187.8	187.8	178.2	178.8
σ, gross scores	45.5	54.8	50.3	38.2
Number taking exam.	103	128	114	111
σ_{av}	4.6	4.9	4.7	3.1

Standard deviation of the difference between the means

1929-1930	0.0447
1929-1931	0.107
1929-1932	2.36
1930-1931	0.0585
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While the $\sigma_{diff.}$'s between the present freshman class and the other three classes are less than 3.00, they indicate a problem for investigation as to the reason for the large values

Determination of "eta" between the weights of the gross scores on the psychological test and the weights of the college averages. Psychological test, (X), college averages, (Y).

	0	1	2	3	4	F_y	D_y	$(FD)_y$	$(FD^2)_y$
4									
3		1	2	8	4	15	1	15	15
2		8	17	5	1	31	0	0	0
1	2	6	13	4		25	-1	-25	25
0	2	4	1			7	-2	-14	28
F_x	4	19	33	17	5	78		-24	68
Y'_x	1	1.81	2.11	2.73	3.3				
Y'_x-Y'	-1.2	-.4	-.1	+.5	+1.1				
$(Y'_x-Y')^2$	1.44	.16	.01	.25	1.21				
$F_x(Y'_x-Y')^2$	5.76	3.04	.33	4.25	6.05	=19.43			

$$\$_{my} = \sqrt{19.43/78} = 0.5$$

$$eta_{yx} = 0.5/0.88 = 0.57$$

Determination of "eta" between the weights of the gross scores on the psychological test and the weights of the college averages. Psychological test, (X), college average, (Y).

1929 Edition

	Score	Percentile
Completion		
Artificial Language		
Analogies		
Arithmetic		
Opposites		
Gross Score		

Psychological Examination

For High School Graduates and College Freshmen

Prepared by L. L. Thurstone and Thelma Gwinn Thurstone
The University of Chicago

Name.....
(Last name) (Given names or initials)

.....

.....

.....

Published by
The American Council on Education
For official use in accredited colleges and high schools
26 Jackson Place, Washington, D. C.

Completion

DIRECTIONS: Think of the most appropriate word to complete each of the sentences. The number in each space indicates the number of letters in the most appropriate word for that space. Do not waste too much time on any one sentence, as you will be credited with one point for every word correctly supplied.

1. A person not of full legal age is a (5)_____.
2. An (6)_____is one chosen to rule on the plays of a game.
3. A (6)_____is one skilled in judging the merits of literary or artistic work.
4. The rites used in the disposition of a dead human body constitute a (7)_____.
5. (5)_____is anything having a conventional use as a medium of exchange.
6. A (5)_____is a kind of heavenly body, having a long nebulous train, or tail.
7. A (4)_____is an ode or song of praise or adoration of God.
8. A (7)_____is a bundle made up for transportation.
9. A (6)_____is a difference between cost and selling price that is in favor of the seller.
10. A (3)_____is a sack or pouch for holding something.
11. A (7)_____is a soft pillow or pad to rest on or against.
12. A (7)_____is any communication sent from one person to another.
13. (9)_____is the withdrawal of a state from the national union.
14. An (5)_____is a foreign-born resident of a country in which he is not a citizen.
15. A (6)_____is a letter or syllable added to the end of a word to modify its meaning.
16. An (3)_____is an aviator who has been cited for achievement in bringing down enemy planes.
17. A (8)_____is a professional prize fighter.
18. One without means except such as come from charity is a (6)_____.
19. A (4)_____is a place from which minerals are got by washing the soil.
20. A (5)_____is a gross violation of human law.
21. An inlet of the sea smaller than a gulf is a (3)_____.
22. A (8)_____, like a simile, is a figure of speech based on similarity.
23. A lighted coal smouldering in ashes is an (5)_____.
24. (12)_____is the seizure of private property for the public use.
25. The last part or end of anything is called its (10)_____.
26. The dark-colored viscid syrup drained from sugar in manufacture is called (8)_____.
27. A (8)_____is the base or support of a statue.

Go to the next page. Do not wait for any signal.

28. The sum of the qualities that determine the value of an auditorium as to distinct hearing is called its (9).....

29. A (7).....is a scheme for the distribution of prizes by chance.

30. (8).....is the right of voting in political matters.

31. A wooer or lover is called a (6).....

32. A (6).....is a sheath for carrying arrows.

33. A (5).....is a gem carved in relief.

34. A (7).....is a prisoner, especially in war.

35. A (9).....is a lizard notable for changing its color.

36. A (8).....is the highest non-commissioned officer in the army.

37. A (10).....is a courteous expression of commendation.

38. By (13).....law is meant the body of rules and precedents by which deliberative assemblies govern their procedure.

39. A (6).....is formed by inlaying small pieces of different colors.

40. (9).....is canvas waterproofed with tar.

Stop here. Wait for further instructions.

Artificial Language

DIRECTIONS: Read the vocabulary and rules of the artificial language given below. Then study the sample sentences. Do not try to memorize the vocabulary or forms, but consult them freely while translating the sentences on the bottom half of this page.

VOCABULARY

I—av
me—aver
he—aj
him—ajer
that—rin
is—nar
agree—frega
decide—prista
express—bana
impress—guda

RULES

1. Plurals are formed by adding "ay." Only nouns and pronouns have plurals.
   Examples: we—avay
   them—ajeray
2. Past time is expressed by placing "lo" before the verb.
   Example: agreed—lofrega
3. Future time is expressed by placing "sta" before the verb.
   Example: will agree—stafrega
4. Nouns are formed by substituting the ending "il" for the "a" ending of the verb.
   Example: agreement—fregil
5. Adjectives are formed by substituting the ending "uc" for the "a" ending of the verb.
   Example: agreeable—freguc
6. Adverbs are formed by substituting "ef" for the "a" ending of the verb.
   Example: agreeably—fregef

SAMPLE SENTENCES

(*a*) He agrees.
Aj frega.

(*b*) Avay staprista.
We shall decide.

(*c*) That was impressive.
Rin lonar guduc.

(*d*) Pristil nar freguc.
Decision is agreeable.

Translate as many of these sentences as you can in the time allowed. Translate the sentences in order 1, 2, 3, etc. *Do not skip any sentence.* If a complete sentence is omitted, no credit will be given for any work done beyond that point, but if a particular word bothers you, go on to the next word.

1. He is agreeable.
2. Rin loguda aver.
3. He agreed decisively.
4. Pristil nar guduc.
5. I will impress them.
6. Aj lobana pristil.
7. Expression is agreeable.
8. Pristil bana fregil.
9. They will agree decisively.
10. Fregil nar pristuc.
11. We shall express agreement.
12. Pristil loguda ajer.
13. That expression impressed him.
14. Aj lobana fregil pristef.
15. He impressed me agreeably.
16. Rin fregil lonar guduc.
17. That decisive agreement impressed us.
18. Pristuc banilay guda fregef.
19. That decisive expression will impress us agreeably.
20. Ajer bana pristil; rin nar guduc.

Stop here. Wait for further instructions.

Analogies

(Prepared by Prof. Lewis O. Anderson, The University of North Dakota)

DIRECTIONS: This is a test of your ability to see relationships between various drawings or figures. The two samples, A and B below, illustrate what you are to do. Look at sample A. The two short lines are underlined because they are related to the third figure (single line) in the same way as the second figure (two dots) is related to the first figure (single dot).

Look at sample B. The large white square is underlined because it has the same relation to the third figure as the second figure has to the first figure. In this case the underlined figure is larger and of the opposite color, as compared with the third figure. Thus, the figure to be underlined must be related to the third figure in every way that the second is related to the first.

In the examples which follow you are to UNDERLINE THAT FIGURE WHICH HAS THE SAME RELATION TO THE THIRD FIGURE AS THE SECOND HAS TO THE FIRST. Underline one and only one figure in each row.

Stop here. Wait for further instructions.

Arithmetic

DIRECTIONS: Write the answers to as many of these problems as you can in the time allowed.

1. A tailor uses $9\frac{3}{4}$ yards of cloth for a suit. How many yards will it take for 32 suits?

   Answer: .....yards

2. A man starts to work at $140 a month and receives an increase of $5 a month every 6 months. In how many years will he be earning $190 a month?

   Answer: .....years

3. A man earns $6 a day half the time, $4.50 per day one-fourth of the time, and nothing on the remaining days for a total period of 40 days. What did he earn in all in the 40 days?

   Answer: $.....

4. Three men catch 144 trout, and share them according to the number of persons in the family of each. In A's family there are 4 persons, in B's family there are 5, and in C's, 7. How many does C take home?

   Answer: .....trout

5. A man spends $\frac{3}{5}$ of his monthly salary for board, $\frac{1}{4}$ for other expenses, and saves $12. What is his monthly salary?

   Answer: $.....

6. How many times as fast does an airplane going 90 miles an hour travel as a vehicle that requires 6 minutes to go a mile?

   Answer: .....times as fast

7. A man owns $\frac{2}{3}$ of a boat and sells $\frac{3}{4}$ of his share for $750. At this rate, find the value of the boat.

   Answer: $.....

8. A dealer sold a horse for $175 and lost $12\frac{1}{2}\%$. How much money would he have gained if he had sold the horse for 10% more than the cost?

   Answer: $.....

9. If the market value of corn is 60 cents a bushel, what is the price of oats when a farmer should give $3\frac{3}{4}$ bushels of corn for 5 bushels of oats?

   Answer: .....cents per bushel

10. A watch that gained 3 minutes and 12 seconds per day was set right at noon Monday. What time was it by this watch at 6 p.m. the following Tuesday?

    Answer: .....hr.....min.....sec.

You may use this space for figuring.

Go to the next page. Do not wait for any signal.

1929 Edition

11. Cork is about ¼ as heavy as water, and silver is about 10 times as heavy as water. How many times as heavy as cork is silver?

Answer: .....times as heavy

12. A man's house is 45 feet from his garage. How many steps, each 2¼ feet in length, will he take in making two round trips from the house?

Answer: .....steps

13. If a dealer sells goods at a profit of 50%, but fails to collect 10% of the sales, what per cent of profit is he really making?

Answer: .....%

14. A man invested a sum of money and sold at 10% profit. He then invested the principal and profit and sold at 4% loss. The selling price was $2112. What was the original sum invested?

Answer: $.....

15. Of his weekly wages, B spends ¾, gives 10% in charity, and saves $78 a year. Find B's weekly wages.

Answer: $.....per week

16. If we use ½ of a cup of starch to 4½ cups of water in making starch, the starch is what per cent of the mixture?

Answer: .....%

17. Two pipes empty into a tank which already contains 1000 gallons. One pipe fills the tank at the rate of 20 gallons per minute and the other at the rate of 25 gallons per minute. How many gallons will the tank contain after 16 hours?

Answer: .....gallons

18. At 8 p.m. the barometric pressure was 29.4, and at 1 a.m. following it was 32.4. Assuming a constant rate of increase in the barometric pressure, at what time was the pressure 30.1?

Answer: .....hr.....min.....sec.

19. In a certain park a lake covers 32 acres. The area of the lake is to the land area of the park as 1 to 4¼. Find the area of the entire park.

Answer: .....acres

20. What is the age of a man who has lived ¼ of his life in A, 10% of the remainder in B, and the remaining 27 years in C?

Answer: .....years

Stop here. Wait for further instructions.

You may use this space for figuring.

Opposites

DIRECTIONS: Each group of four words in the thirty lines below contains two words which are either (*a*) the same or nearly the same in meaning, or (*b*) the opposite or nearly the opposite in meaning. Find the two words in each group that are either the same or opposite, and write the numbers of these two words in the column at the right, headed "Same" or the column headed "Opposite" as the case may be.

The first group of words, "1. many, 2. ill, 3. few, 4. down," contains two words ("many" and "few") that are opposite in meaning, so that the figures 1 and 3 are entered in the column headed "Opposite." The second and third groups have also been marked correctly.

				Same	*Opposite*
1 many	2 ill	3 few	4 down	.....&.....	..1..&..3...
1 fair	2 near	3 gone	4 far	.....&.....	..2..&..4...
1 gay	2 long	3 lost	4 happy	..1..&..4...	.....&.....
1 hasty	2 refreshed	3 fatigued	4 fanatic	.....&.....	.....&.....
1 original	2 oral	3 copied	4 derelict	.....&.....	.....&.....
1 nocturnal	2 traditional	3 prime	4 customary	.....&.....	.....&.....
1 nimble	2 agile	3 cloudy	4 reliable	.....&.....	.....&.....
1 untrue	2 expensive	3 new	4 novel	.....&.....	.....&.....
1 canine	2 rigid	3 feline	4 flexible	.....&.....	.....&.....
1 temporary	2 momentous	3 vigilant	4 eternal	.....&.....	.....&.....
1 obsolete	2 outworn	3 bucolic	4 rampant	.....&.....	.....&.....
1 rural	2 senile	3 urban	4 septic	.....&.....	.....&.....
1 genuine	2 authentic	3 asinine	4 cabalistic	.....&.....	.....&.....
1 showy	2 remedial	3 ostentatious	4 remonstrant	.....&.....	.....&.....
1 oracular	2 presumptive	3 suppositional	4 chimerical	.....&.....	.....&.....
1 tolerant	2 nominal	3 indulgent	4 jocose	.....&.....	.....&.....
1 supernal	2 aurous	3 eager	4 averse	.....&.....	.....&.....
1 sinewy	2 tipsy	3 rotund	4 spherical	.....&.....	.....&.....
1 existential	2 infinite	3 imaginary	4 religious	.....&.....	.....&.....
1 clumsy	2 vapid	3 gruesome	4 adroit	.....&.....	.....&.....
1 gelatinous	2 vacuous	3 merciful	4 clement	.....&.....	.....&.....
1 egregious	2 solitary	3 misogynous	4 gregarious	.....&.....	.....&.....
1 defamatory	2 laudatory	3 onerous	4 propitious	.....&.....	.....&.....
1 reciprocal	2 filial	3 esoteric	4 mutual	.....&.....	.....&.....
1 illicit	2 admonitory	3 monetary	4 pecuniary	.....&.....	.....&.....
1 paramount	2 inimical	3 residual	4 amicable	.....&.....	.....&.....
1 intrepid	2 accidental	3 sufficient	4 courageous	.....&.....	.....&.....
1 predatory	2 preemptive	3 garish	4 quiet	.....&.....	.....&.....
1 inhibitory	2 relevant	3 dynamic	4 pertinent	.....&.....	.....&.....
1 maladroit	2 itinerant	3 vindictive	4 generous	.....&.....	.....&.....

Stop here. Wait for further instructions.

Thesis
Warren, E.C.
1933

Warren, Elmer Chapman
The 1929 American council on education psychological examination and its relations to the first semester, freshman year scholarship of the class of 1933 at a northeastern college of liberal arts.